



## SAN BERNARDINO MICROWAVE SOCIETY, Incorporated

FOUNDED IN 1955

A NON-PROFIT AMATEUR TECHNICAL ORGANIZATION DEDICATED  
TO THE ADVANCEMENT OF COMMUNICATIONS ABOVE 1000 MC.

### W6IFE Newsletter November 2012 Edition

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At the **November 1, 2012 SBMS meeting** will have someone speak. The SBMS meets at the American Legion Hall 1024 Main Street (south of the 91 freeway) in Corona, CA at 1900 hours local time on the first Thursday of each month.

**Last meeting-** Doug, K6JEY talked about his trip to the EME Conference in England and a following trip to Ben, EA3XU station in Barcelona, Spain. The EME conference had some 170 folks in attendance. Doug gave us the run down on a talk about the HP8974 Noise Figure Measuring instrument that is as far as anyone can go with current technology in noise measurement. The 8974 runs about \$40,000 where as the predecessor 8970 can be found for around \$1,000 in the surplus market. Microwave operation in Europe is mostly from home stations where they use a "logger" program on the internet to schedule contacts and chat about contacts. Thanks Doug for the information about European hams. The 4 new tables SBMS purchased for the American Legion hall had arrived and were set up for the SBMS meeting. The old ones were put out back of the hall for anyone's use with American Legion approval. Bruno, KA6ZXD of Riverside was our visitor. Doug, K6JEY announced he would form a beacon committee and with \$500 voted upon by the membership, he would see about getting a synthesizer from Tony, KC6QHP. Others named to the committee were Chris, N9RIN, Dick, WB6DNX and Mel, WA6JBD. There was discussion between having a permanent beacon and one that was portable/ temporary on a site. The proposed site would be Johnstone Peak. Rein, W6SZ is going to contact Dave, WA6CGR about getting the SBMS website updated and putting more technical papers on the site. ATV'ers listening in was Robby, KB6CJC.

With many thanks to Rein W6SZ, my talk from last week's SBMS meeting titled, "Microwaves in Europe" can be found here: [http://www.nitehawk.com/k6jey/k6jey\\_dwnload.html](http://www.nitehawk.com/k6jey/k6jey_dwnload.html) Doug K6JEY

#### **Scheduling:**

**November 3-4 50 and 1296 MHz ARRL International EME Competition.**

**December 1-2 50 and 1296 MHz ARRL International EME Competition**

**December 6 SBMS meeting TBD**

**January 3, 2013 SBMS meeting TBD**

**February 7 SBMS meeting TBD**

#### **Wants and Gots for sale.**

**For Sale:** 30w 1296 MHz PA kit \$50 + \$5 for US shipping Chris Shoaff, N9RIN cshoaff@yahoo.com

**For Sale:** 10 GHz slotted waveguide antennas \$55 kit, \$80 assembled plus shipping Dan W6DFW [W6DFW@apex-scientific.com](mailto:W6DFW@apex-scientific.com)

**For Sale:** Microwave Solutions 3.4 GHz PA 1mw in6w out 12vdc Matry N6VI 818-773-9655.

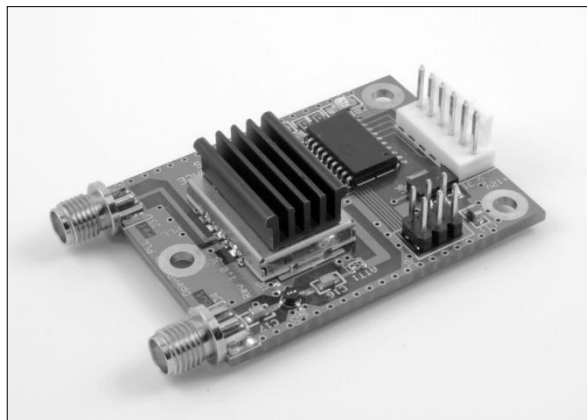
**Want:** 60 to 100 feet of EW90 waveguide Pat [N6RMJ@sbcglobal.net](mailto:N6RMJ@sbcglobal.net) 661-755-1773

**FOR SALE:** Leupold 3-9 VARI X-II scope. Optically perfect but the reticule does not adjust properly. Would be great for aiming at mm frequency dish or an optical system. Make me an offer. Jeffrey Fort 760-948-7227 [JNJFORT@VERIZON.NET](mailto:JNJFORT@VERIZON.NET)

**NEED-** HP 8694 8-12 GHz sweeper plug-in for 8690 main frame Chuck WA6EXV 760-382-0709

**Activity** reports from the 4 October SBMS meeting. Dick, WB6DNX is working on his 10 GHz rig that broke during the contest; Chuck, WA6EXV got a PLL synthesizer from Chris, N9RIN to fix the Heaps beacon; Bill, WA6QYR had a rig break during the contest and used a spare of AF6NA's to work from Frazier; Ed, W6OYJ had some 40 different calls during the contest on 10 and 24 GHz; Tom, WB6UZZ is collecting EME rig parts; Courtney, N5BF had fun in the 10 GHz contest; Rein, W6SZ had a WSPR contact with Mel from Mount Potosi and has been working on contacts on 20 meters, 2 meters and 10 GHz using WSPR; Bill N6MN worked the contest from Catalina Island; Mel, WA6JBD had a 651 km contact to Mount Vaca from Mount Potosi during the contest and worked several home station that had omni-antennas; Jeff, KN6VR worked from Frazier mountain and attempted WSPR contact with W6SZ; Jason, W6IEE had wind problems on SS51; Pat, N6RMJ worked from SS51 and SS14 during the contest; Larry, K6HLH worked the contest from home and did some WSPR 2 meter contact with W6SZ at 10 mw levels; Brian had fun on Frazier Mountain during the contest; Doug, K6JEY has a new Electrocraft KX3 radio and worked from Signal Hill during the contest; Chris, N9RIN operated from Frazier Mountain.

**60 degrees North Electronics Company.** I am starting up a kit making service for assembling certain kits made by Down east Microwave. For those that do not want to make their own kits or maybe it's gotten too difficult, or just don't have the time or want assembled kit faster than DEMI can supply it. This one-man business so I will only be able to build a limited number per month. My price is the same as offered by DEMI assembled, plus shipping which should be medium-size flat-rate priority mail in the US. I am expecting to be able to deliver within 30 days of receipt of paid order. I am not carrying any inventory so this allows shipping time to obtain kits and any other materials, and time to test the finished product plus ship to the customer. At this time I am limiting this to the VHF/UHF 25w Transceiver kits. In a couple months I hope to add three amplifier kits from Communications Concepts, Inc. If there is something special you want assembled contact me. My professional credentials are at: <http://www.k17uw.com/60NE.htm> Ed Cole



Introducing the **OpenSynth** line of frequency synthesizer kits. Available in standard frequencies of 2556, 2952, 2160, 1152, 3312, 3006 MHz, also available from 400 MHz to 3500 MHz.

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- ⤴ 2" x 1.5", 12V @ 140 mA typical

**Available at** <http://reactancelabs.com>

## 2012 10 GHz and Up Cumulative Contest

Posted on **September 19, 2012** by **Tony, KC6QHP**

This year marks my ~15th time participating in the ARRL's 10 GHz and Up Cumulative Contest. The purpose of the contest is to further the state of the art in Amateur Radio equipment and operation at frequencies of 10 GHz and above (my personal favorite end of the Amateur Radio spectrum).

Each year over the course of two weekends, participants attempt to communicate with one another (exchanging very basic information including call signs and a geographical locator code). Points are determined by a combination of

number of unique stations contacted per band, as well as the sum of the distance between stations for each contact.

Two categories exist, the first being "10 GHz only" and the second includes participants who make contacts on bands above 10 GHz. The reason for this is that 10 GHz is much more popular and contacts are significantly easier than on the higher bands. This distinction encourages different kinds of competition (requiring different operational and technical skills)

This year I competed in the 10 GHz and Up category. I made 110 contacts on 10 GHz, 10 contacts on 24 GHz, and 1 on 47 GHz. My longest contacts on each band are: 351 km on 10 GHz, 103 km on 24 GHz, and 56 km on 47 GHz/

For the first weekend I took a trip to the local San Bernardino Mountains, specifically to Green Valley Lake, where some relatives have a cabin. I stayed the night and on Saturday morning drove to the top of Keller Peak.

KC6QHP's 10 GHz radio set up below the Keller Peak fire lookout tower

For portable operation I power my microwave radios with large sealed lead acid batteries. These are a pain to move around but provide sufficient energy to operate the power hungry radios for a full weekend without recharge. A full load with all 5 radios running can approach



100 watts (in receive mode).

Keller Peak, at 2317 m (7882 ft) high makes for a great spot to operate microwave radios. AT&T took advantage of this decades ago with the installation of a hardened microwave backbone site at the top of the mountain back in the days before fiber optics.

After several hours of working stations as far away as San Diego, and into California's Central Valley, the sky started to get very dark, and I decided to pack up for the day. Rain does not mix well with sensitive electronics, and lightning does not mix well with me.

Later in the day I drove back towards home and finally set up near the Marine Exchange of Southern California, a former Nike Missile site and before that, Fort MacArthur.



10 and 24 GHz radios adjacent to Fort MacArthur / Marine Exchange in San Pedro, CA

From this point I made a few contacts, and then headed home to Redondo Beach for final late night contacts.

On Sunday I operated from home and made some nice contacts on 10 and 24 GHz. I always enjoy working microwave from indoors, it just shouldn't work 😊

For the September weekend I operated entirely from home because I was sick and didn't have the energy to haul tons of equipment out. I had planned on heading to San Diego and operating from Mt. Soledad and making some attempts on the 79 GHz band.

Instead, I operated from home and made lots of great contacts including my first indoor 47 GHz contact with Steve W6QIW at Secret Site 51 (a name us hams have given to ITT's Loop Canyon Test Facility and former Nike site LA-94). This was a 56 km contact, which is not bad for the 6mm band, but even more exciting because my radio was indoors, looking out through a window towards a house across the street!

I operated two 10 GHz radios from home, including one I put on the roof with an Omni-directional slotted waveguide antenna.

A question to the experts:

I have been working on some 10 GHz amps at 10 Watts level lately. All though I haven't been feeling uncomfortable, longer lasting exposure to microwaves should not be underestimated, mainly due to the heating effects inside the human body, especially in the eyes.

I try to do most of the snow-flaking at low levels to minimize radiation coming out of the open amplifier but placing little copper foil bits close to expensive Power FETs isn't easy as we all know and sometimes my head has to come pretty close so I can see what I am doing. I use one of those desk lamps that have a big magnifying glass built in. It will not attenuate radiation in a big way but at least it helps to increase the working distance a bit. I wonder how others tackle this problem and how would it be done professionally in RF labs or so? 73 Daniel

Years ago, when I was tuning RF amps professionally, we would take an RF sniffer and probe around the amplifier. Actual levels are hard to measure, but I remember one, we had that was pretty bad, so we built a cover of copper mesh screen and poked holes in the screen where the tuning tools went. Output power went up significantly (1/2 dB) with the screen in place, so a fair amount was lost to radiation.

At 10 GHz, a small horn on a power meter will be enough to find harmful radiation. Even a small horn has a capture area of several square cm, so a power level of 1 mw/cm<sup>2</sup> or less is easy to detect. Less than that is probably safe for short exposures.

If the radiation is bad, you are wasting power. Some impedance matching structures are worse than others. Caution is good 73 Paul

Good Morning All,

I was exposed to high RF while working on 432 antenna arrays back in the 70's. I felt my eyes "dry out" and I got the heck out of there! It took a month the dry eyes feeling to disappear.

I have also done a bunch of snow flaking here and had others doing tuning at work without covers on and with a long enough exposure your eyes start to feel tired. At work I had tuning covers made as Paul describes, and the technician complained about tired eyes...when he was not using the covers!

I have used a small old Radio Shack microwave oven "sniffer" to check out hot spots and get an idea of how much stray RF is present. I am not sure how good it is at 10 G but it is probably still a good relative indicator.

Certainly limit your exposure time and proximity if possible. I have considered making and using a metal screen face mask.

Caution is good. Barry VE4MA

Perhaps it's time to plan tuning a bit better and make the tuning elements adjustable from outside a closed box. Snow-flaking is too expensive when eye damage can be a result.

Perhaps something like 3 piston trimmers at 1/8th or 1/4 wave intervals on input and output lines. One thing about trimmers is that they aren't likely

to short which is a hazard while snow-flaking. Sure the half dozen trimmers will raise the cost, but the first effect of too much RF in the eyes is documented in MIT Rad Lab where they reported 10 mw from WR90 was enough when close to a rabbit's eye to cause a cataract. Cataracts are correctable these days, at a cost of \$6K per eye or so, plus months of healing. So far all the costs have been covered by Medicare and my supplemental insurance except for prescription drugs. My cataract was caused by old age, but made much worse by the laser treatment for a detached retina and the eye drops following that treatment. It turned the lens into a fuzzy thing that wouldn't focus light. I've recovered well enough to build a DEMI 3 watt PA which I didn't apply RF power with the cover off.

I typically have used those three shunt trimmers with minimum reactance about 1/2 the line impedance. That would be like tuning screws in waveguide where such a three screw tuner is reputed (in MIT Rad Lab series) to tune most any load. If 1/8th wave is too close, 5/8th wave ought to work just as well, though it may lengthen the enclosure.

Usually in such a three screw tuner, all three screws are not needed, two nearly always should work and sometimes one is enough. Or like Barry's 24 GHz waveguide preamp, a series of holes at close intervals needs only one screw in the right hole. I think a screw won't be enough capacitance in a coax line even at 10 GHz without getting the gap uncontrollably small. The commercial version might be a slot with a carrier for one screw to achieve the same result with more waveguide machining.<sup>73</sup>, Jerry, K0CQ

My work in the Health Physics field was all with ionizing radiation. But our professional organization, the Health Physics Society, is also involved with RF radiation and there have been some excellent articles in our monthly journal: "Health Physics, The Radiation Safety Journal", as well as on the Health Physics Society's web site.

The scientific consensus is that the only harmful effects of RF on the human body is heating, and it takes very high levels of RF to produce heat that one can actually feel. (YouTube videos aside, you can't make popcorn with a cell phone!) Itching or dry eyes, headaches and such are not necessarily due to RF exposure. Correlation is not the same as causation- My eyes sometimes itch and get dry just watching TV, and I'm not convinced TV watching is the cause. (Although I suspect it may cause one's brain to atrophy!) Even the link to cataracts is not all that strong- very high levels of microwave radiation can sometimes cause cataracts but it's not a certainty by any means. Most of us who eventually develop cataracts will get them for reasons other than RF exposure. (My cataract was caused by steroids used to treat iritis, not from playing with microwaves.)

As low as the risk is (Pretty close to zero for the power levels most of us work with) Paul's advice is good. The mantra for those of us in the HP field is "As low as reasonably achievable". It's not hard to limit or reduce exposure (Remember the Inverse Square Law?) and worth doing so.

Chip, W1AIM

Not much help, but I sometimes find myself in an old AT&T microwave hub. The equipment has long been disconnected and removed. But a sign on the wall caught my attention. It read "Do not look in to the open end of waveguide with your one good eye." N3izn

Hi Chip, with all respect to the professionals in the field, the "drying of eyes" was real, although I know it was doubted by the professionals contacted by Joe W1JR at the time also. This was an effect that appeared in tens of seconds, not hours or days later. Perhaps dry eyes is a poor way to describe



it...it was like you had been awake for 30+ hours or you had been working in a dusty area...eyes really wanted to be closed. We don't work in high power levels necessarily, but at the frequencies we are dealing with (10 GHz in particular) the power density from small apertures (feed-horns and point source radiator strip-lines) can be quite significant.

Best 73 Barry VE4MA

Somewhat related: several years ago I worked in a commercial 2-way radio shop which also serviced marine radar. Some of the techs were lazy and ran the magnetrons with open w/g for testing until I complained of getting a headache from that (came on in about 15-min of exposure). Most run about 3kw peak on 3-GHz. I could tell when anyone did this in short time, every time....dummies! We had w/g loads. 73, Ed - KL7UW

Strip lines radiate like antennas. Not efficiently but primarily from the current in the line. And when an amplifier enclosure is broad enough to act as a waveguide (over 1/2 wavelength) the conversion from strip line to waveguide mode can couple from the output line to the input line and cause the amplifier to oscillate, only when the case is covered.

That's often cured with cross or length wise baffles and/or chunks of some RF lossy material glued to the cover.

Besides incorporating tuners adjustable from outside the closed case, we might use a scope and diode detector for relative output instead of a thermal power meter and then pulse the drive to only apply drive for a short time, like a millisecond or less after moving the snowflake. With 100 MHz bandwidth scopes and diode detectors with 1 GHz detected bandwidth a few microseconds should be enough time to see it with the scope.

And for existing amplifiers we could add on external tuners for input and output, but not interstage tuning. 73, Jerry, K0CQ

In my freshman college physics class, we used 10GHz Gunnplexers for experiments. There was a similar warning "Do not look directly into waveguide", on a label on the INSIDE back wall of the cavity.

Dave AA3EE

Gents, well, it looks like there is no off-the-shelf solution to the problem. I was hoping someone would come up with some sort of protective glasses with a fine metal grid inlay or a similar solution that would attenuate microwaves effectively. My own web search ahead of this post was not very successful, thus my interest in the professional way of dealing with RF exposure.

I think we can basically do 3 things:

1. Reduce exposure time: John, G3XDY suggests to use a pulsed low duty cycle RF source. Quote. Set a pulse generator to a repetition rate of 100Hz and pulse width of 100uS and then you are running at an average power of 1% of the peak power. A thermal power meter will indicate the average power so add 20dB to get the peak power for a 1% duty cycle...unquote

An excellent idea. Modulators are cheaply available surplus, even in the 10 GHz range. Or you can also try to modulate the IF of your transverter. This should get you pretty close to the optimum. Still you will have to do the final tweak at maximum power.

2. Maximize the distance from the RF source: Use good illumination and some sort of magnification so your head is away from the RF source.

Will my glasses or a magnifier increase the RF field near my eyes by focusing the microwaves, or will the glass or plastic lenses not promote this "optical" effect due to physical size or the materials used?

Has anyone tried one of those USB cams?

3. Go QRP: Not really a solution ;-)

Thanks for your thoughts and input.

Discussions on the effects of RF on the human body tend to get extremely emotional very quickly, at least in the "real world" outside our hobby, and I personally try to avoid them. However, I think we all should be aware of the possible dangers....Snow-flaking is too expensive when eye damage can be a result. Well spoken, Jerry! 73s Daniel DL3IAE

Decades ago, there was a government program for High Power Microwave (HPM). As I recall, they published some handbooks, maybe through SRI that are probably around somewhere. One area addressed was the effects of HPM on sensitive parts of the human body, the eyes being one of the most sensitive areas. I believe they designated safe levels as 10 mw/cm<sup>2</sup> but not for too long of a period. The safe level is probably somewhat frequency sensitive as there's a reason microwave ovens operate around 2.6 GHz. Water is apparently more absorptive at that wavelength than other microwave frequencies, and in spite of what other may think, you and other flesh are basically comprised of 80% water; hence the best cooking frequency. So is foliage.

In reading electronic warfare history, I saw somewhere that watchmen on ships in the North Atlantic during WW II would stand on the bow of ships and get the radar operators to beam the antenna toward them to warm them up, or thaw them out, whatever the case was. I wouldn't recommend it!

Ben/K4QF

I believe the frequency for cooking was also determined because of penetration depth. Lower frequencies penetrate deeper and higher frequencies produce heat closer to the surface. Think medical diathermy for internal body tissue heating. Some operate at 27 MHz. Watch a few YouTube CB shootouts and you will see what lots of kilowatts of 27 MHz can do to one's brain :)

Dex

I've seen food cooked at 27, 915, and 2450 MHz. They all worked, 27 was industrial, 915 and 2450 made for residential and commercial applications. With those frequencies designated for industrial heating, and I don't know of any besides those three so designated, the regulations help set a design. Then a magnetron for 915 is kind of bulky compared to a 2450 MHz magnetron and if the oven has standing waves they are closer together at the higher frequency. I don't think domestic cooking 915 MHz ovens have been made in the last 40 years. The last one I saw, looked like a double oven electric range.

There have also been reports that microwave exposure of certain body parts made the male human temporarily sterile so sometimes radar or dew line tropo RF was applied before late night recreational outings by troops it's been said. In WW2, sailors didn't have such recreational opportunities at sea, only in port.

73, Jerry, K0CQ



ON another thread about antistatic materials, here is some experimental data I thought was interesting-Bill

So whether that metal layer is one molecule thick or 1 mil thick, we wouldn't be able to see through it if it's solid, so the particles, whether one molecule or 1 mil in section are spaced apart? And probably embedded between solid plastic layers to absorb, but not necessarily conduct electric fields. Spaced close enough to break down the gaps with a voltage small enough to not do serious damage to the encased parts being protected? Possibly one sided? An insulating film supporting a partially conductive film?

OK, I just took a pseudo Fluke to a roll of solar absorbing film that I picked up at Axman in the last year. Inside surface, shows open on auto range. Set on megohm range, the outside surface shows varying resistance, as low as 10K with probes a quarter inch apart. The changes in resistance drive the auto range mode batty, but fixed on the 20 Megohm range its almost stable. This film is conductive.

Same meter, anti static bag received from Digi-Key last week. More than 20 megohms (Open circuit as far as the meter is concerned) inside and outside. Same for Mouser anti static bag. And for a pink plastic Ziploc bag from W3IAC and a bigger one that enclosed an entire shipment from Mouser sometime in the recent past. Where's my megger? These resistance checks are probably seriously voltage dependent. Open circuit at low voltages, somewhat conductive at static damaging voltages.

Though as a window in a waveguide they may or may not attenuate RF or be effective as eye protection. Their inner layer MAY spread any static charge induced to their entire surface thus keeping the differential voltage between the "protected" device pins low, or they may be more of a sham than safety for the parts.

I'll have more on amplifier tuning later.

73, Jerry, K0CQ



**Chuck, WA6EXV, Jeff, KN6VR, and Jason, W6IEE look over a TWT.** The San Bernardino Microwave Society is a technical amateur radio club affiliated with the ARRL having a membership of over 90 amateurs from Hawaii and Alaska to the east coast and beyond. Dues are \$15 per year, which includes a badge and monthly newsletter. Your mail label indicates your call followed by when your dues are due. Dues can be sent to the treasurer as listed in the banner on the front page. If you have material you would like in the newsletter, please send it to Bill, WA6QYR at 247 Rebel Road Ridgecrest, CA 93555 or, [bburns@mediacombb.net](mailto:bburns@mediacombb.net), or phone 760-375-8566. The newsletter is

generated about the 15<sup>th</sup> of the month and put into the mail at least the week prior to the meeting. This is your newsletter. SBMS Newsletter material can be copied as long as SBMS is identified as source.

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